

# S'COOL BREEZE



Student's Cloud Observations On-Line

Volume 1, Issue 4

March 1999

## From Arizona to France S'COOL team visits Schools

Dave Young had the opportunity to speak to about 40 students taught by Ms. Chris Donovan at Desert View High School in Tucson, Arizona. His discussion of haloes being caused by ice clouds was rather timely, as "amazingly there was a halo around the sun" when students went outside to make an observation for NASA. Dave must have put in an order for the weather, for students observed persistent contrails, another one of Dave's highlighted discussions. With the presence of all 3 levels of clouds Dave led students in identifying cloud type. To top off his visit a rainbow appeared.

Krystal Duran, a student at Desert View, describes Tucson. "It is located in the southwest region of Arizona as well as the U.S. Here in Tucson we have a wide range of temperatures and seasons. From 65 F in January to sometimes 100 degrees F in summer. There is rarely snow because there isn't enough moisture in the air. We live in the Sonoran Desert where it is dry."

Students of CM2 at the J. Jaures School in Le Versoud also enjoyed having NASA visitors this

*continued on page 2*

## Welcome to the CERES "Validation Team"

*Dr. Bruce A. Wielicki, Sr. Research Scientist in the  
Atmospheric Sciences Division, LaRC, Hampton VA*

What is validation? Just a fancy word for "testing." We test our CERES data to see how things work., to see if they work the way we planned and to see if the data is as accurate as we planned.

Why do we care? Can't we just look at the satellite pictures like those on the weather channel and just say whether clouds are there or not? Looks pretty easy on TV! Unfortunately looks can be deceiving. Clouds seem simple until you get to know more about them. The water droplets that make up cumulus clouds are typically only .01 mm in diameter! How small is that? Let's play "Honey, I Grew the Drops!" Let's say I want to grow a cloud droplet until it is your size: say 4 feet tall or 1.2m. If I grew you by the same amount as that water droplet, how big would you become? As tall as a tree? As tall as a skyscraper? The answer is that if I grew you as much as that water droplet, you would become 150 km tall! You would stand so high that jet airplanes would be flying below your knees. So now you can imagine just how small cloud droplets are.



Observing in the snow: St. Pierre d'Entremont, France.

## INSIDE THIS ISSUE

- 1 Message from Dr. Bruce Wielicki
- 1 S'COOL Visits
- 3 Good Cloud Websites
- 3 Activity with Radio Waves
- 3 Electronically Speaking

## **Dr. Bruce** (Continued from page 1)

But wait: it turns out that we would have no clouds at all if we had no aerosols in the atmosphere. What's an "aerosol"? This is what we call a very small particle or droplet that is not water, but might be wind-blown dust, or salt from the ocean, or small particles containing carbon emitted when power plants or cars burn oil, coal, or gasoline. These particles are typically 100 times smaller than cloud water droplets!! So: how big would you be if I grew an aerosol particle up to your size, and then grew you by the same amount?

Whoa! Now you are up to 15000 km tall. With two friends you could link hands and surround the entire Earth like a belt! Yet without these tiny aerosols for cloud droplets to grow on there would be no clouds! So you can think of these tiny aerosols as the seeds for cloud drops. So how many aerosols are in the atmosphere? Turns out that depends on where you are and how clean the air is. These aerosols get rained out of the atmosphere in a week or two. So the further you are from the land sources of most aerosols, the fewer you find in the air. Over ocean, there are typically 50 or fewer in every cubic centimeter of air. Over many land areas, especially near cities, there are ten times as many particles in the air. Just for fun, let's count up how many aerosol particles would be in a 100 square meter house or apartment. Try it for 100 particles in every cubic cm.

If you have 2.5 m high ceilings, my calculator tells me you have roughly 20 billion aerosol particles in the air in your house. Why does this number affect clouds? Since clouds form on these small particles, the amount of water vapor in the air that condenses to form cloud droplets gets spread over more and more droplets as the number of particles increases. This makes each individual droplet smaller. Why does droplet size matter?

Imagine each of the aerosols in your house (the 20 billion we just talked about) seeds a cloud droplet. Each cloud droplet is typically 10 microns or 0.01 mm in diameter. If I gathered all the water from these 20 billion tiny water droplets and put it all in one big drop, how big would it be? Well, that single drop that held all of the water in that cloud filling your house would have a diameter of about 3 cm! (Your teacher can help you work that one out using the formula for the volume of a sphere.) So all those 20 billion water droplets have the same amount of water as a single droplet 3 cm across.

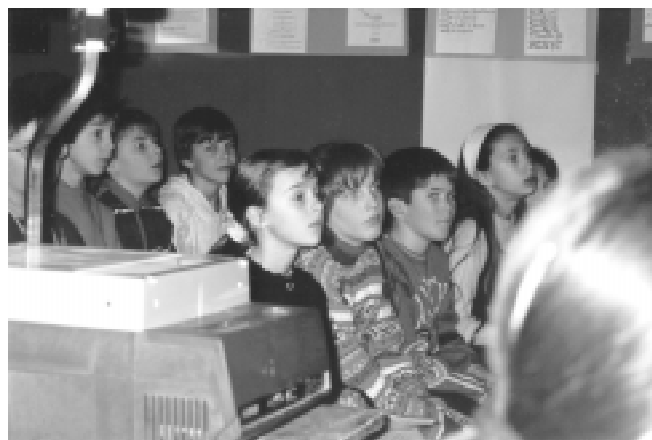
Now, think of what a cloud at the ground might be: right! Its fog! And clouds reflect the sun's energy back to space (shading and cooling us down on the ground). But both you and the Sun can see much easier through a house with a single 3 cm water droplet, than through a fog-filled house. So as the water in clouds collects on fewer bigger drops, more sunlight gets through to the surface to heat the Earth. Since burning oil, coal, and gasoline increases the number of

aerosols in the atmosphere, we think that these aerosols are making the clouds more reflective to sunlight, and therefore slightly cooling the Earth. But at the same time carbon dioxide, released in burning the same fossil fuels, acts to warm the Earth by providing what is called a "greenhouse" effect. Currently, we think that the greenhouse effect is bigger than the aerosol effect, and so we expect the Earth to warm. But we don't yet know how much!

So you can see that clouds can be tricky! Sometimes even the size of the tiny cloud particles can be important. CERES measures how much sunlight the clouds reflect back to space, and with the S'COOL kids' help to test our cloud measurements, we can better understand how clouds work! ★

## **FROM ARIZONA TO ...** (Continued from page 1)

past January. Lin Chambers, director of the S'COOL project, and Doreen Neil, assistant chief of the Atmospheric Sciences Division, were there to answer questions. Teacher Claude Arnaud's students wrote that they had learned a great deal that they did not previously know thanks to their visitors' explanations. The school in Le Versoud backs right up to the foothills of the Alps, so the students in this school have an interesting observational setting. Clouds and haze often fill the valley, while the nearby mountains are clear - this the students can observe in winter as the class takes afternoon trips to a nearby ski area.



**S'COOL students at Ecole Jean Jaures in Le Versoud, France.**

St. Pierre d'Entremont, another French school visited by Lin, is nestled in a valley between two peaks. Here again is a situation where the clouds in the valley may bear no relation to conditions even a few miles away. "Indeed, as I left the school in bright sunshine, we climbed to a high mountain pass, traveled through a narrow tunnel and came out in dense fog!" states Dr. Chambers. "Indeed, mountainous settings are about the only place where one can reliably estimate the altitude of a cloud," she added.

## CLOUD WEBSITES

### THE FOLLOWING SITES HAVE GOOD CLOUD PICTURES.

<http://bertjr.mb.ec.gc.CA/ENGLISH/>

follow site to Air/Weather (Also in French)

<http://covis2.atmos.uiuc.edu/guide/clouds/>

<http://vortex.plymouth.edu/clouds.html>.

<http://athena.wednet.edu/curric/weather/riclooud/index.html>

[http://asd-www.larc.nasa.gov/asd\\_over/new\\_asdover.html](http://asd-www.larc.nasa.gov/asd_over/new_asdover.html)

## TRY THIS

### RADIO WAVES AND THE ATMOSPHERE

#### MATERIALS:

#### RADIO

#### DIRECTIONS

1. In the evening locate as many radio stations as you can.
  2. Record each station, its call numbers and its location.
  3. In the morning repeat steps (1) and (2).
- **CONCLUSIONS**
4. What was the most distant station?
  5. Were you able to listen to the same station in the morning that you named in step 4?
  6. Which layer in the atmosphere enabled you to pick up on these radio stations?
  7. In what layer of the atmosphere are the clouds you observe for S'COOL?

➤ **EXTENSION**

8. Research the layers of the atmosphere and list the outstanding characteristics of each layer.

**French translation by Stephanie Weckmann**



Ecole Jean Jaures students listen to instructions during Lin Chambers' visit.

## NEWS BULLETIN

S'COOL now has registered 222 school sites in 19 countries on 6 continents represented.

**TEACHERS: PLEASE** let us know how many students you had participating this year. Stickers will be mailed in May.

**Remember to use Daylight Savings Time** when it applies in your area.



Fredriik is giving some thought to the weather situation at his school at Dal-Jerksskolan in Rattvik, Sweden. Fredriik's teacher is Mats Furugard.

## ELECTRONICALLY SPEAKING:

Smile :-) frown :-(

Laughing :-D wink ;-)

Wide-eyed 8-) Oh, no! :-O

NASA Langley Research Center  
ATT: S'COOL Project  
Mail Stop 420  
Hampton, VA 23681-2199



### **Upcoming events**

CERES Validation Month  
S'COOL Intensive Observing Period  
April, 1999

CERES Science Team Meeting  
April 27 - 29, 1999

EOS AM Launch/July 1999

For more information contact us by:

S'COOL Project  
Mail Stop 420  
NASA Langley Research Center  
Hampton, VA 23681-2199

Phone: (757) 864-5682  
FAX: (757) 864-7996  
E-mail: [scool@larc.nasa.gov](mailto:scool@larc.nasa.gov)  
<http://asd-www.larc.nasa.gov/SCOOL/>  
Carolyn Green, editor